

**REMARKS**

Claims 26, 28-31, 33-35 and 37-48 remain pending. Applicants respectfully request reconsideration of the above-referenced application in light of the following remarks.

Claims 26, 28-31, 33-35 and 37-48 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,348,365 ("Moore") in view of U.S. Patent No. 5,972,792 ("Hudson"). The rejection is respectfully traversed.

Applicants respectfully submit that Moore is not a proper prior art reference. The present application is a continuation of U.S. patent application no. 09/943,187, filed on August 29, 2001, which issued as U.S. Patent No. 6,784,018, on March 13, 2003. Accordingly, the earliest effective filing date of the present application is August 29, 2001. U.S. Patent No. 6,348,365 ("Moore") was filed on March 2, 2001, and issued on February 29, 2002. As a result, Moore qualifies as prior art only under 35 U.S.C. § 102(e).

The subject matter of Moore and the claimed invention were, at the time the invention was made, subject to an obligation of assignment to the same entity: Micron Technology, Inc. The Assignee of Moore is shown on the face of the reference which is Micron Technology, Inc. The Assignment filed on April 16, 2004 for the above-referenced continuation application also indicates that the Assignee is Micron Technology, Inc. Therefore, section 35 U.S.C. § 103(c) is applicable.

According to MPEP § 706.02(l)(1), "[e]ffective November 29, 1999, subject matter which was prior art under former 35 U.S.C. 103 via 35 U.S.C. 102(e) is now disqualified as prior art against the claimed invention if that subject matter and the claimed invention 'were, at the time the invention was made, . . . subject to an

obligation of assignment to the same person.” Accordingly, Moore is not a valid prior art reference and should be excluded under 35 U.S.C. § 103.

Therefore, the rejection of claims 26, 28-31, 33-35 and 37-48 as being unpatentable over Moore and Hudson should be withdrawn.

Claims 26, 28-31, 33-35 and 37-48 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,487,106 (“Kozicki”) in view of Hudson. The rejection is respectfully traversed.

The cited references do not disclose or suggest a method comprising, *inter alia*, “forming a first conductive electrode . . . forming a chalcogenide comprising material . . . forming a metal-containing layer over the chalcogenide comprising material; diffusing at least a portion of said metal-containing layer into said chalcogenide comprising material . . . [which] forms a rough outer surface on said chalcogenide comprising material; exposing a portion of said rough outer surface to an iodine comprising fluid that reduces the roughness of said outer surface by *etching away at least a portion of said rough outer surface*; and forming a second conductive electrode material,” as recited in claim 26 (emphasis added).

The cited references do not teach or suggest a method comprising, *inter alia*, “forming a chalcogenide glass layer; forming a metal-containing layer . . . forming a rough outer surface on at least a portion of said chalcogenide glass layer by diffusing at least a portion of said metal-containing layer into said chalcogenide glass layer . . . and, smoothing said rough outer surface with an iodine comprising fluid that *removes at least a portion of said rough outer surface*,” as recited in claim 31 (emphasis added).

Similarly, the cited references do not disclose or suggest a method comprising, *inter alia*, "forming a semiconductor substrate; forming a first dielectric layer . . . forming a first conductive layer . . . forming a second dielectric layer . . . forming an opening in at least a portion of said second dielectric layer, wherein at least a portion of said first conductive layer is exposed; forming a chalcogenide glass layer . . . forming a metal-containing layer . . . diffusing at least a portion of said metal-containing layer into said chalcogenide glass layer, wherein said step of diffusing forms a rough outer surface on said chalcogenide glass layer; *removing at least a portion of said rough outer surface* with an iodine comprising fluid to form a smoother surface; and, forming a second conductive layer," as recited in claim 35 (emphasis added).

The Office Action asserts that Kozicki discloses "removing at least a portion of rough outer surface to form a smoother surface by chemical mechanical planarization (CMP)," and cites to Kozicki's Col. 6, l. 62 through Col. 7, l. 4. Applicants respectfully submit that this is *not* what the claims recite and that the Office Action is not considering the claimed invention as a whole. See M.P.E.P. § 2141.02.

Claim 26 recites, *inter alia*, forming "a rough outer surface on [a] *chalcogenide comprising material*; [and] exposing a portion of said rough outer surface to an iodine comprising fluid that reduces the roughness of said outer surface by *etching away at least a portion of said rough outer surface*." (emphasis added). Claim 31 recites, *inter alia*, "forming a rough outer surface on at least a portion of [a] *chalcogenide glass layer* by diffusing at least a portion of said metal-containing layer into said chalcogenide glass layer . . . and, smoothing said rough outer surface with an iodine comprising fluid that *removes at least a portion of said rough outer surface*." (emphasis added). Claim 35 recites, *inter alia*, "forming a chalcogenide glass layer . . . forming a metal-containing layer . . . diffusing at least a portion of said metal-containing layer into said chalcogenide glass

layer, wherein said step of diffusing forms a rough outer surface on said *chalcogenide glass layer*; removing at least a portion of said rough outer surface with an iodine comprising fluid to form a smoother surface.” (emphasis added).

In other words, the chalcogenide glass layer is the layer that undergoes an etching process. Kozicki *does not* disclose or suggest a CMP process conducted on a *chalcogenide glass layer*. Kozicki’s Col. 6, l. 62 through Col. 7, l. 4, indicates that the *only* layer that possibly undergoes a CMP process is *insulating layer 150*. Kozicki’s insulating layer 150 is formed onto electrode 130 and vias are formed within insulating layer 150. Kozicki clearly states that “any excess material remaining on a surface of *insulating layer 150* may be removed, using, for example, chemical mechanical polishing and/or etching techniques.” (Col. 7, ll. 2-4) (emphasis added).

“A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention.” M.P.E.P. § 2142.02(VI). In this case, Kozicki discloses a CMP process only on insulating layer 150 and *not* a chalcogenide glass layer after a metal diffusion into the chalcogenide glass layer which produces a roughened surface. The only motivation to CMP a chalcogenide glass layer is obtained from Applicants’ disclosure. This is improper hindsight reconstruction. For at least this reason, Kozicki is not a prior art reference against the claimed invention.

The Office Action acknowledges that Kozicki does *not* disclose or suggest using a potassium iodine solution for a CMP process. As a result, the Office Action relies on Hudson for the use of such a solution and summarily concludes that it would have been obvious to combine the two references to increase the throughput of a CMP process. Applicants respectfully disagree. There is no motivation to combine the references since the Hudson reference discloses a CMP process on a *metal layer* and, at

best, Kozicki discloses a CMP process on an *insulating layer*.

For example, Hudson discloses that "a particle-free potassium iodate planarizing solution of a pH of 4.5," may be used in CMP (Col. 4, ll. 38-45). Hudson, however, *also* discloses that "[a]n important aspect of an embodiment of the invention . . . [uses] an abrasive-free planarizing solution that oxidizes and/or roughens the material of the surface layer *without* dissolving the material of the surface layer." (Col. 3, ll. 29-31) (emphasis added). In other words, "[t]he planarizing solution 144 oxidizes, roughens, or otherwise *interacts* with the material of the surface layer at the front face 14 of the wafer 12 to *form a thin layer on that wafer that is easily removed* by mechanical force." (Col. 3, ll. 47-51) (emphasis added). As a result, Hudson's "present invention is particularly useful for planarizing *metal layers* from the front face 14 of the wafer 112 to form conductive features such as damascene lines." (Col. 4, ll. 30-33) (emphasis added).

Thus, not only does the proposed combination of references *s not* disclose removing/etching portions from a *chalcogenide* layer, the references also cannot be combined to use the Hudson planarizing solution in Kozicki.

Moreover, in forming programmable memory cells, as described in Kozicki, a layer of silver was formed on a resistance variable material and irradiated. (*See also* Applicants' specification, Background, pg. 2 through pg. 3). The applied energy from the irradiation resulted in silver which migrated into the glass layer. (*See also* Applicants' specification, Background, pg. 3). The surface of the glass layer could have "semicircular nodules or bumps anywhere from 50 Angstroms to 20 microns across." (Applicants' specification, Background, pg. 3). Applicants' claimed invention removes these semicircular nodules and bumps from the chalcogenide layer *itself*.

In the present invention, Applicants discovered that exposing a rough outer surface on a chalcogenide material to an iodine comprising solution, substantially removed the bumps and semicircular nodules *from the glass layer itself*, thus avoiding potential problems experienced in forming prior art structures, *i.e.*, the presence of the bumps would create voids upon application of a subsequent layer. Applicants claimed method *etches* away and smoothes the semicircular nodules and bumps by removing some of the material *itself*.

Consequently, "a patentable invention may lie in the discovery of the source of a problem even though the remedy may be obvious once the source of the problem is identified. This is part of the 'subject matter as a whole' which should always be considered in determining the obviousness of an invention under 35 U.S.C. § 103(a)." M.P.E.P. § 2142.02(III). None of the cited references recognize the problem or therefore suggest a solution.

Further still, at best, the cited references would teach forming a *separate layer* on top of a target metal layer, and planarizing the separate layer. The references still would *not* teach or suggest etching or removing away material from a chalcogenide glass layer. As indicated above, Hudson discloses that "[t]he planarizing solution 144 oxidizes, roughens, or otherwise *interacts* with the material of the [metal] layer at the front face 14 of the wafer 12 to *form a thin layer on that wafer that is easily removed* by mechanical force." (Col. 3, ll. 47-51). None of the material of the underlying metal layer *itself* is removed.

As such, even if the references are properly combinable which they are not, they still would not disclose or suggest "exposing a portion of [a] rough outer surface to an iodine comprising fluid that reduces the roughness of [the] outer surface [of the chalcogenide layer] by *etching away* at least a portion of [the] rough outer surface [of the

chalcogenide layer],” as recited in claim 26 (emphasis added), or “*smoothing* [a] rough outer surface [of a chalcogenide layer] with an iodine comprising fluid that *removes at least a portion of [the] rough outer surface* [of the chalcogenide layer],” as recited in claim 31 (emphasis added), or “*removing* at least a portion of [a] rough outer surface [of a chalcogenide layer] with an iodine comprising fluid to form a smoother surface [of the chalcogenide layer],” as recited in claim 35 (emphasis added).

Claims 28-30 depend from claim 26. Claims 33-34 depend from claim 31. Claims 37-48 depend from claim 35. Dependent claims 28-30, 33-34 and 37-48 should be allowable along with their base claim for at least the reasons provided above, and on their own merits.

For instance, the cited references do not teach or suggest that the “iodine comprising fluid is a potassium iodide solution,” as recited in claims 28, 33 and 37. Hudson merely discloses the potential use of potassium iodate with a pH of 4.5. The cited references do not disclose or suggest that the “potassium iodide solution comprises from about 5 to about 30 grams I<sub>2</sub> per liter of a from about 20% to about 50% potassium iodide solution,” as recited in claims 29, 34 and 38.

The Office Action acknowledges that Kozicki and Hudson “fail to disclose the composition of potassium iodide solution.” (p. 6). Hudson discloses a potassium iodate solution and not Applicants’ claimed potassium iodide solution. The Office Action further asserts that it would have been a matter of mere routine optimization to select Applicants’ claimed composition and no evidence of criticality or unexpected results has been set forth.

In response, Applicants respectfully submit that the Office Action fails to set forth a *prima facie* case of obviousness. See M.P.E.P. § 2142. In particular, *none* of the cited references, alone or in combination, teaches or suggests Applicants' claimed composition for a potassium iodide solution. To establish *prima facie* obviousness of a claimed invention, *all* the claim limitations must be taught or suggested *by the prior art*." M.P.E.P. § 2143.03 (emphasis added). As such, it is *inappropriate* to merely conclude that these parameters can be determined through routine optimization.

The Office Action further asserts that the specific thicknesses of the metal-containing layer and conductive layer is a well-known processing variable and is obvious involving routine skill in the art. Again, Applicants respectfully submit that this is *not* the standard for setting forth a *prima facie* case of obviousness. "In this case, neither Kozicki nor Hudson teaches or suggests *any* thicknesses for a metal-containing layer or conductive layer.

As such, the cited references do not disclose or suggest a "metal-containing layer [which] is formed to be less than or equal to 200 Å thick," as recited in claim 44, or a "second conductive layer [which] is formed from about 140 Å to about 200 Å thick," as recited in claim 45. These are additional reasons for the allowance of dependent claims 28, 29, 33, 34, 37, 38, 44 and 45.



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In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to review and pass this application to issue.

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Respectfully submitted,

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